



# Apple-O-Matic Service

Final Presentation

Project Team 25

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# System Problem Statement

- To satisfy a child's hunger quickly and nutritiously



# Summary

## Exploratory Research Stage

- Identify Stakeholder Needs
- Explore Ideas and Technologies

## Concept Stage

- Explore Feasible Concepts and Prototype
- Propose Viable Solutions

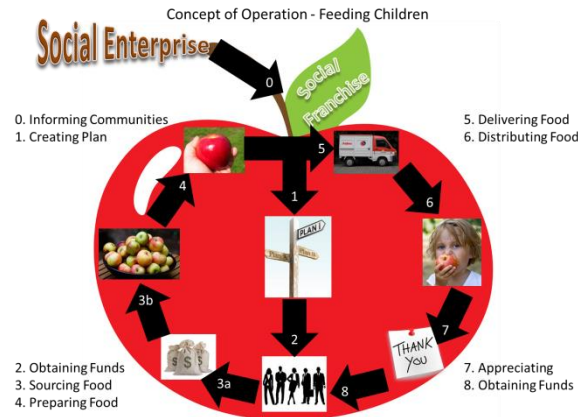
[1]



[2]



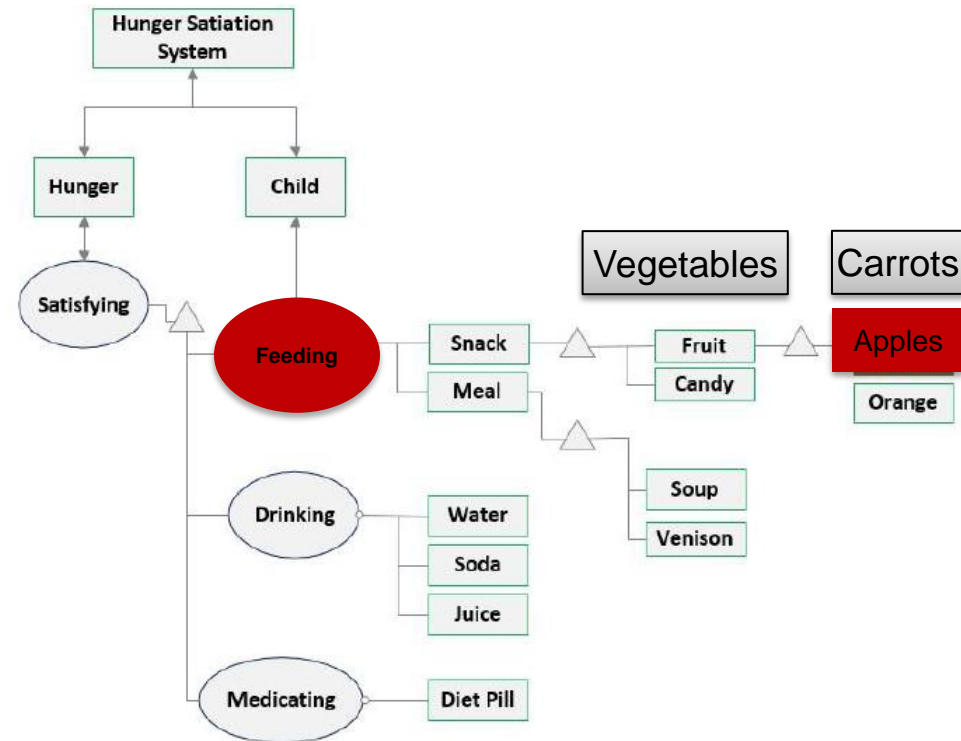
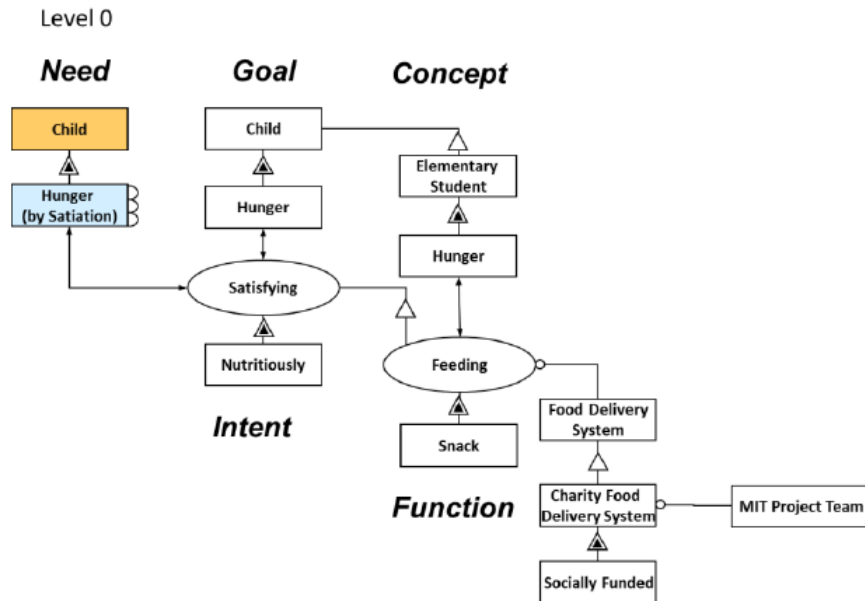
Why are people malnourished in the richest country on Earth?



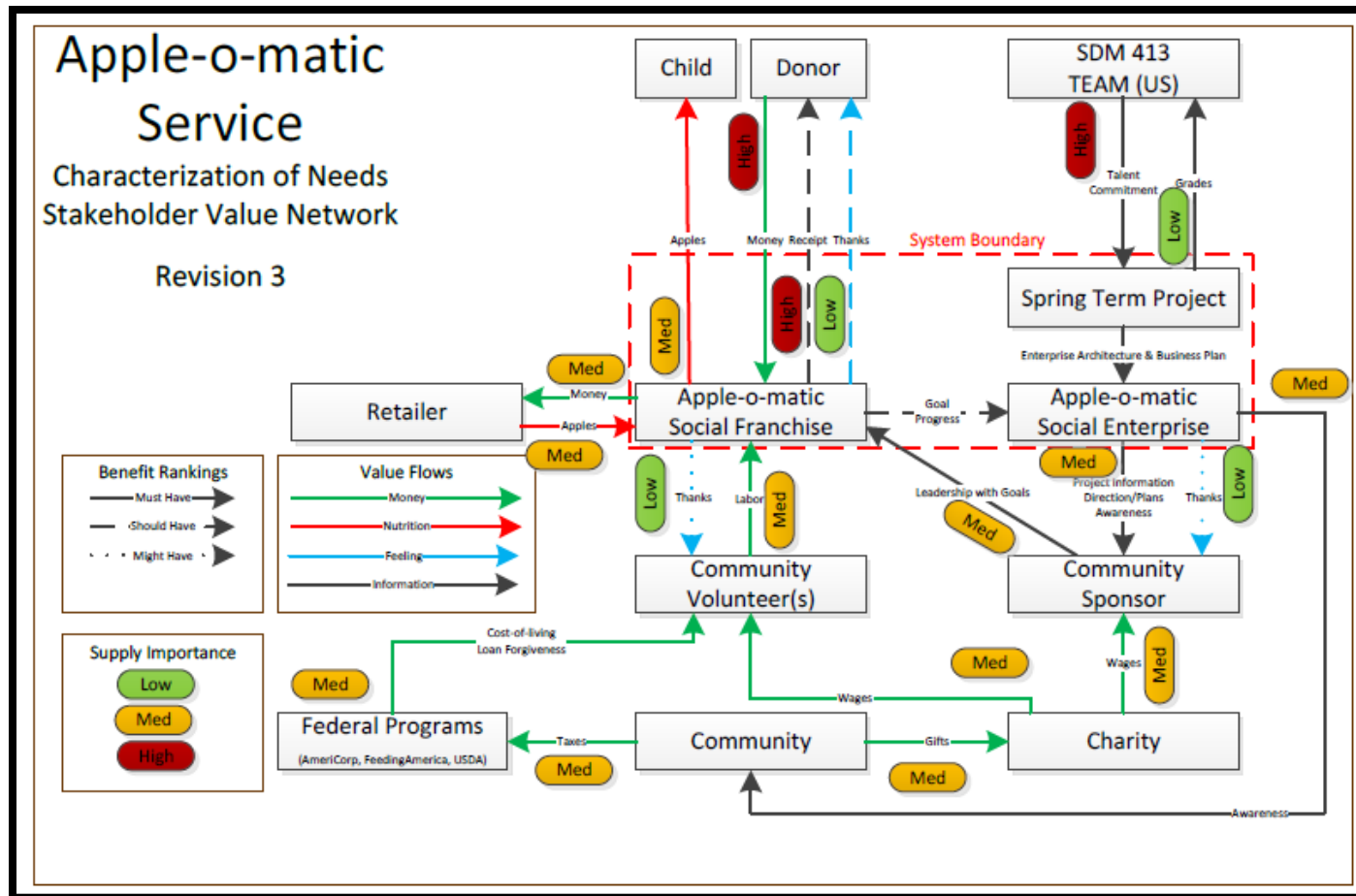
# Defining The Need

Solution Neutral architecture  
defines ultimate need, goal, and  
concept framework

Framework architecture finds specific solutions / options



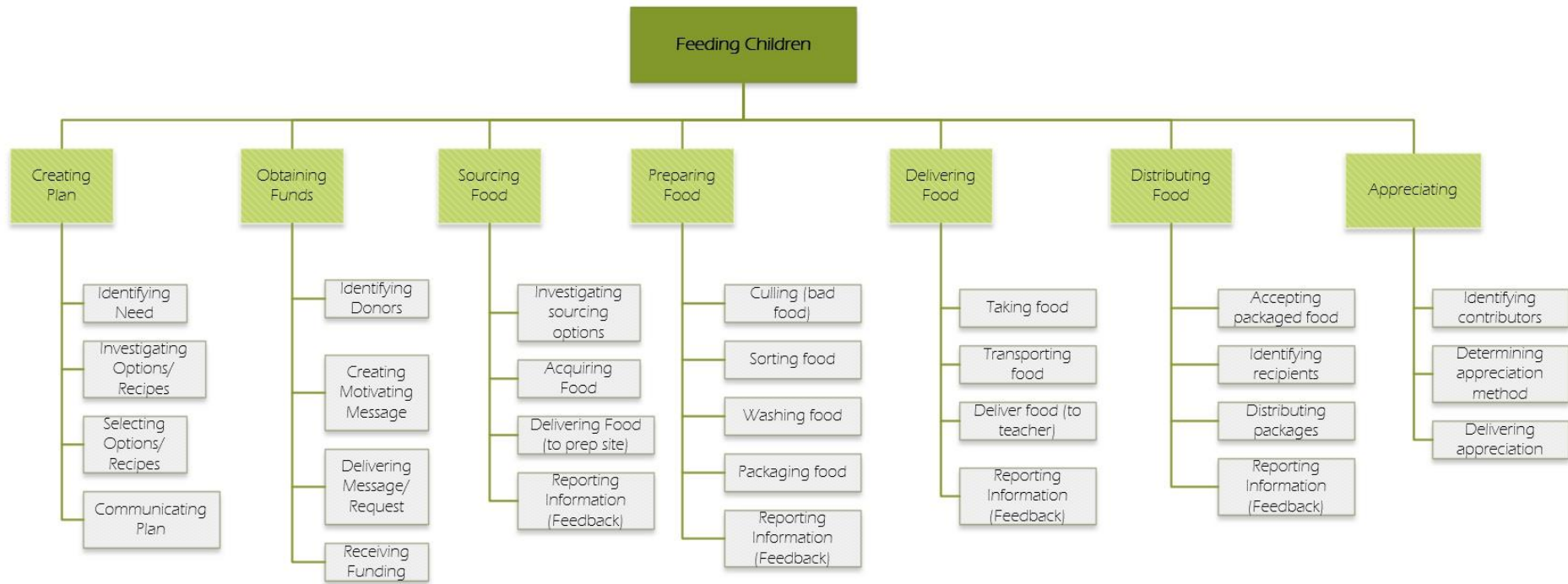
# Stakeholder Network



# Goal Statement

- To satisfy a child's hunger quickly and nutritiously
- By providing elementary students with an apple at the end of the school day
- Using a community-sponsored Apple-O-Matic service using donated resources and based out of a centralized enterprise.

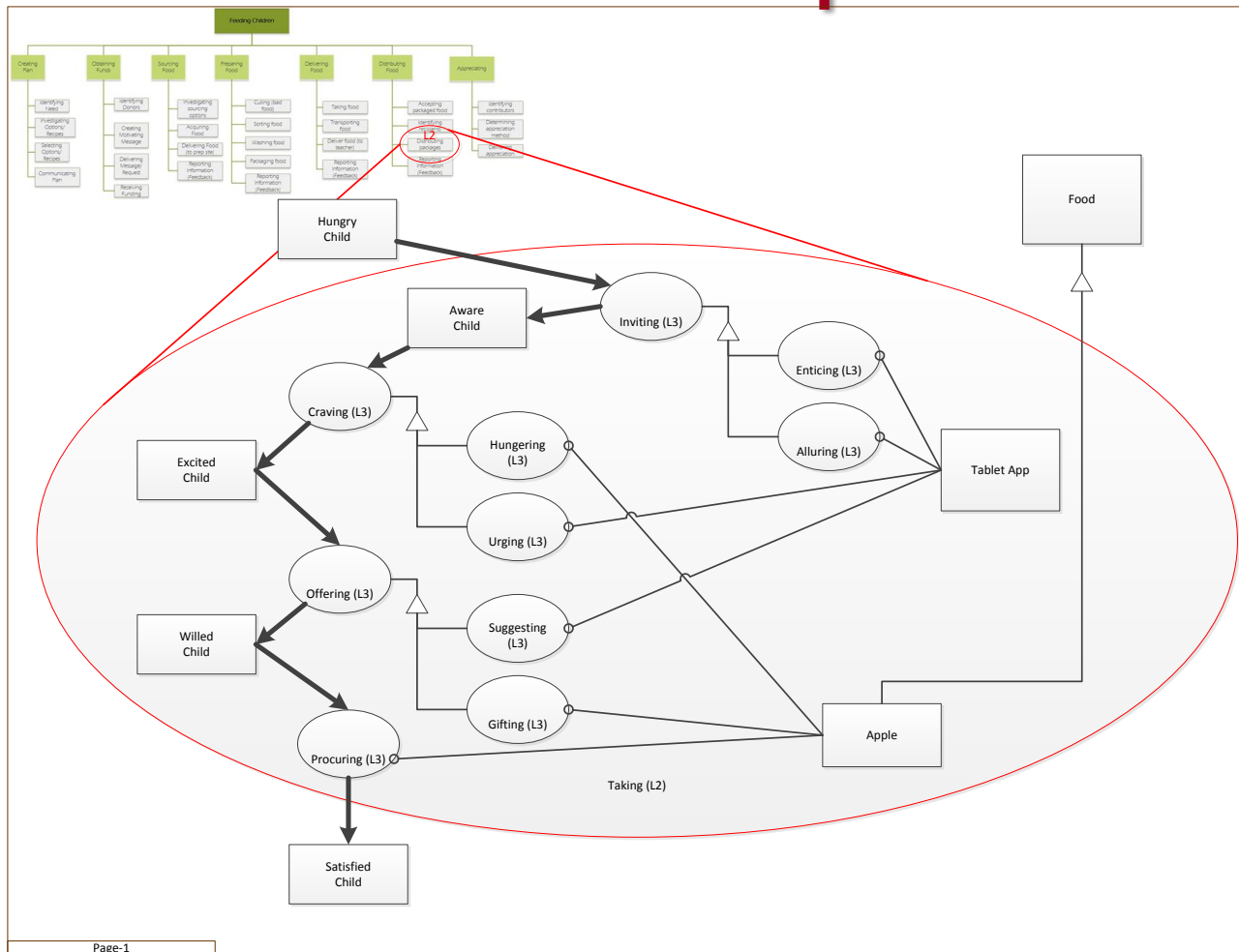
# Level 2 Functional Decomposition



[https://github.com/apple-o-matic/proto1/blob/master/system\\_architecture/Functional\\_Decomposition.vsd](https://github.com/apple-o-matic/proto1/blob/master/system_architecture/Functional_Decomposition.vsd)



# Level 3 Decomposition

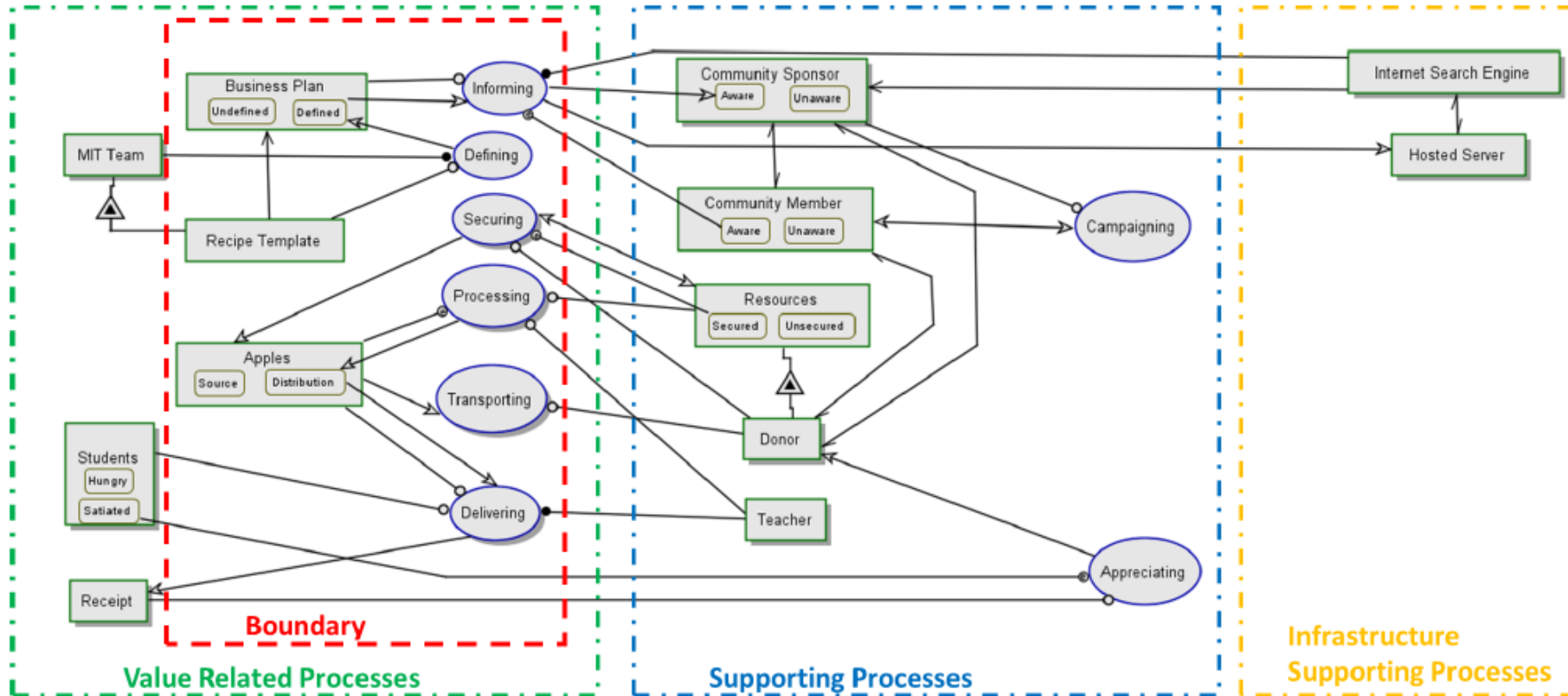


[https://github.com/apple-o-matic/proto1/blob/master/system\\_architecture/Apple-o-matic\\_Architecture\\_v6-L3%20Feeding%20Decomposition.vsd](https://github.com/apple-o-matic/proto1/blob/master/system_architecture/Apple-o-matic_Architecture_v6-L3%20Feeding%20Decomposition.vsd)

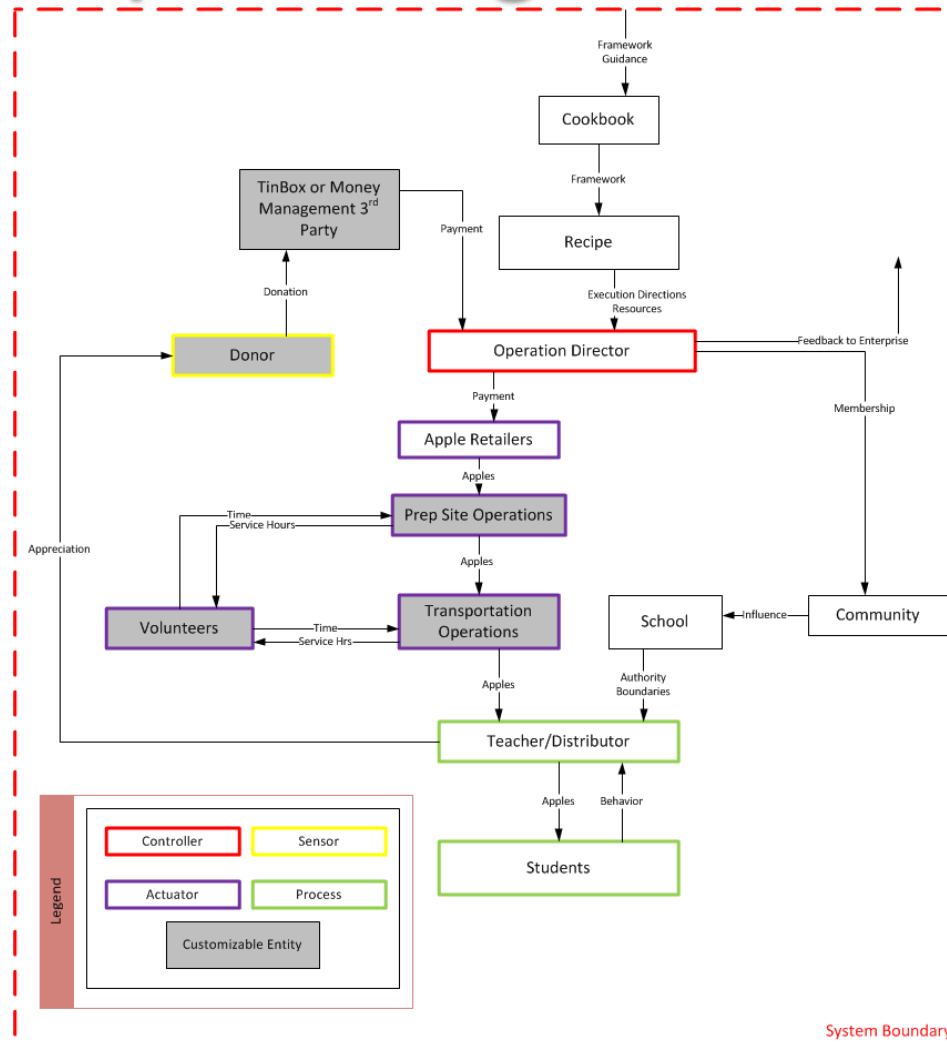
Primary Value: Hungry Child -> Satisfied Child



# System Architecture



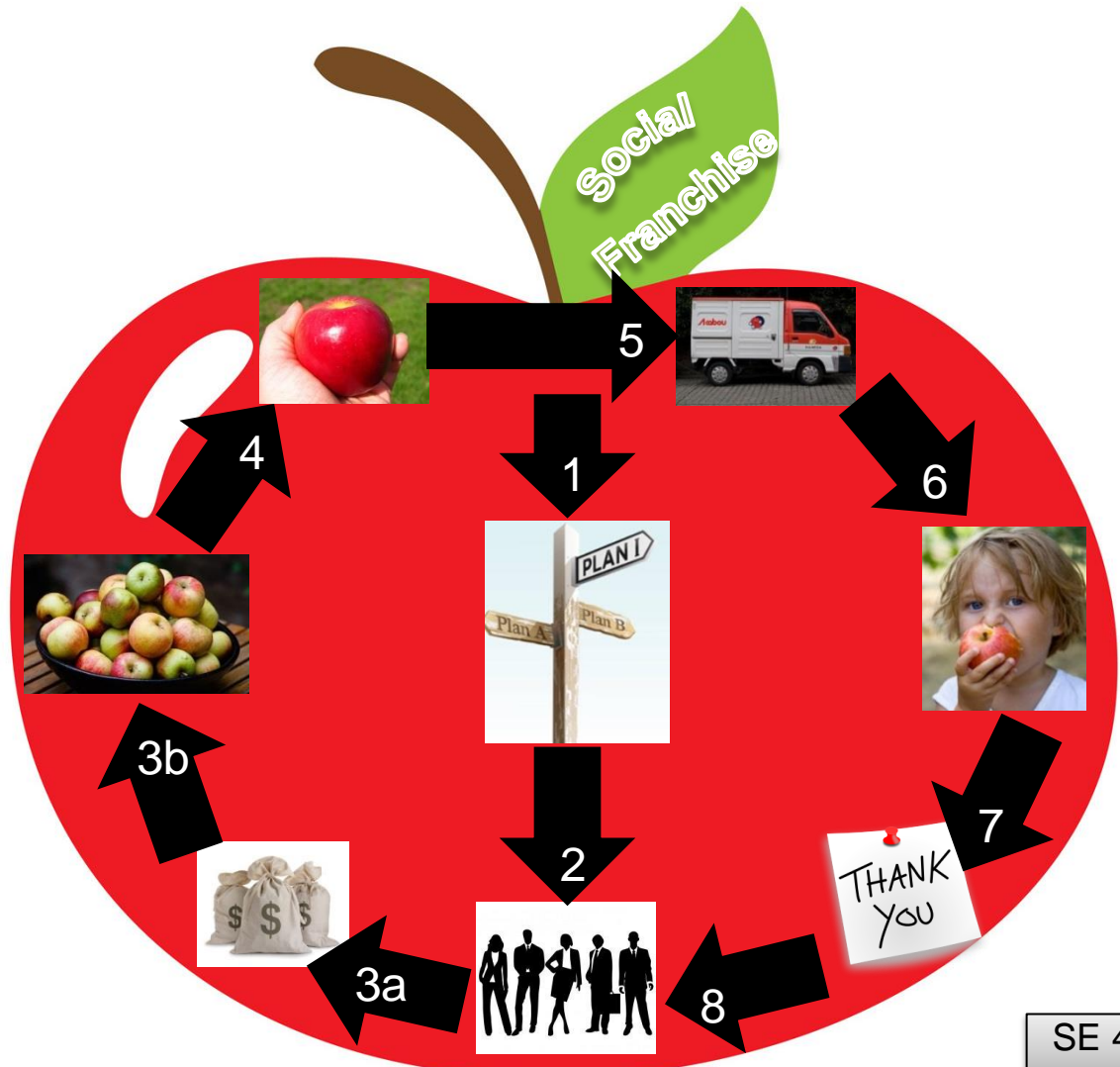
# Operating Process



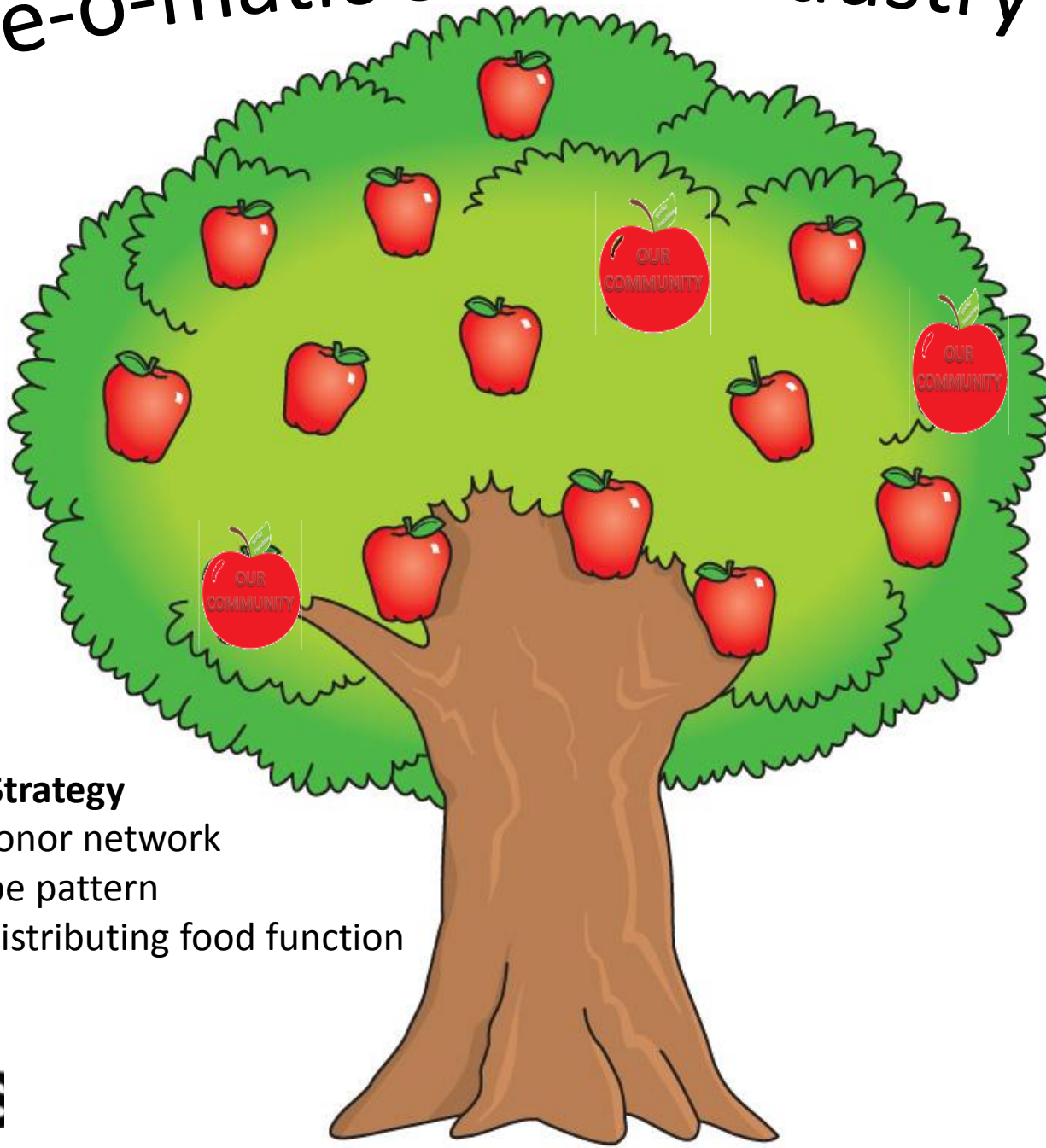
[https://github.com/apple-o-matic/proto1/blob/master/system\\_engineering/Control%20Structures.vsd](https://github.com/apple-o-matic/proto1/blob/master/system_engineering/Control%20Structures.vsd)

# Concept of Operations

1. Creating Plan
2. Obtaining Funds
3. Sourcing Food
4. Preparing Food
5. Delivering Food
6. Distributing Food
7. Appreciating
8. Obtaining Funds



# Apple-o-matic Service Industry Platform



## Platform Strategy

Scalable donor network

Fixed recipe pattern

Modular distributing food function

# Key Requirements

ID	Stakeholders	Needs	System Requirements
A.A.1	A. Child	Hunger Satisfied	The System shall feed apples during time of hunger.
A.A.2	A. Child	Nutritious snack	The system shall make healthy snacks available to children.
A.B.1	A. Child	Balanced Nutrition	The system shall provide a nutritious snack
B.A.1	B. Apple-o-matic Enterprise	Enterprise Architecture	The system shall have a clearly defined architecture.
B.B.1	B. Apple-o-matic Enterprise	Business Plan	The system shall have a clearly defined business plan.
C.B.1	C. Sponsor	Confidence of Actual Impact	The System shall publish metrics for existing community implementation.
C.D.1	C. Sponsor	Coordination Skills/Tool	The system shall provide templates to setup social franchise
C.D.2	C. Sponsor	Easy setup of project	The system shall be easy to setup.
C.E.1	C. Sponsor	Personally Inexpensive project	The System shall not require monetary distribution from sponsor.
D.A.1	D. Donor	Tax Deduction	The System shall be a tax exempt entity.
D.B.1	D. Donor	compelling message to donate	System administrator shall create compelling message to donate, to be delivered to potential audience.
D.C.1	D. Donor	Feedback from beneficiary	The donor shall have the ability to receive feedback from teacher and or students
D.D.1	D. Donor	Safe money handling	The system shall manage donor funds appropriately
E.A.1	E. School	Safe food for children	The system shall ensure security of the food provided to children.

[https://github.com/apple-o-matic/proto1/blob/master/system\\_engineering/Apple-o-matic\\_Requirements.xlsx](https://github.com/apple-o-matic/proto1/blob/master/system_engineering/Apple-o-matic_Requirements.xlsx)

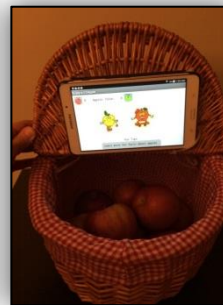
# Feasibility Evaluation Plan

Quality attributes to verify high risk architecture decisions:

- **Students hungry when provided apples**
- **Acceptance of the apples by students**
- **Responsive donor network for acquiring apples**



1. Load Basket with apples (22-25 small)



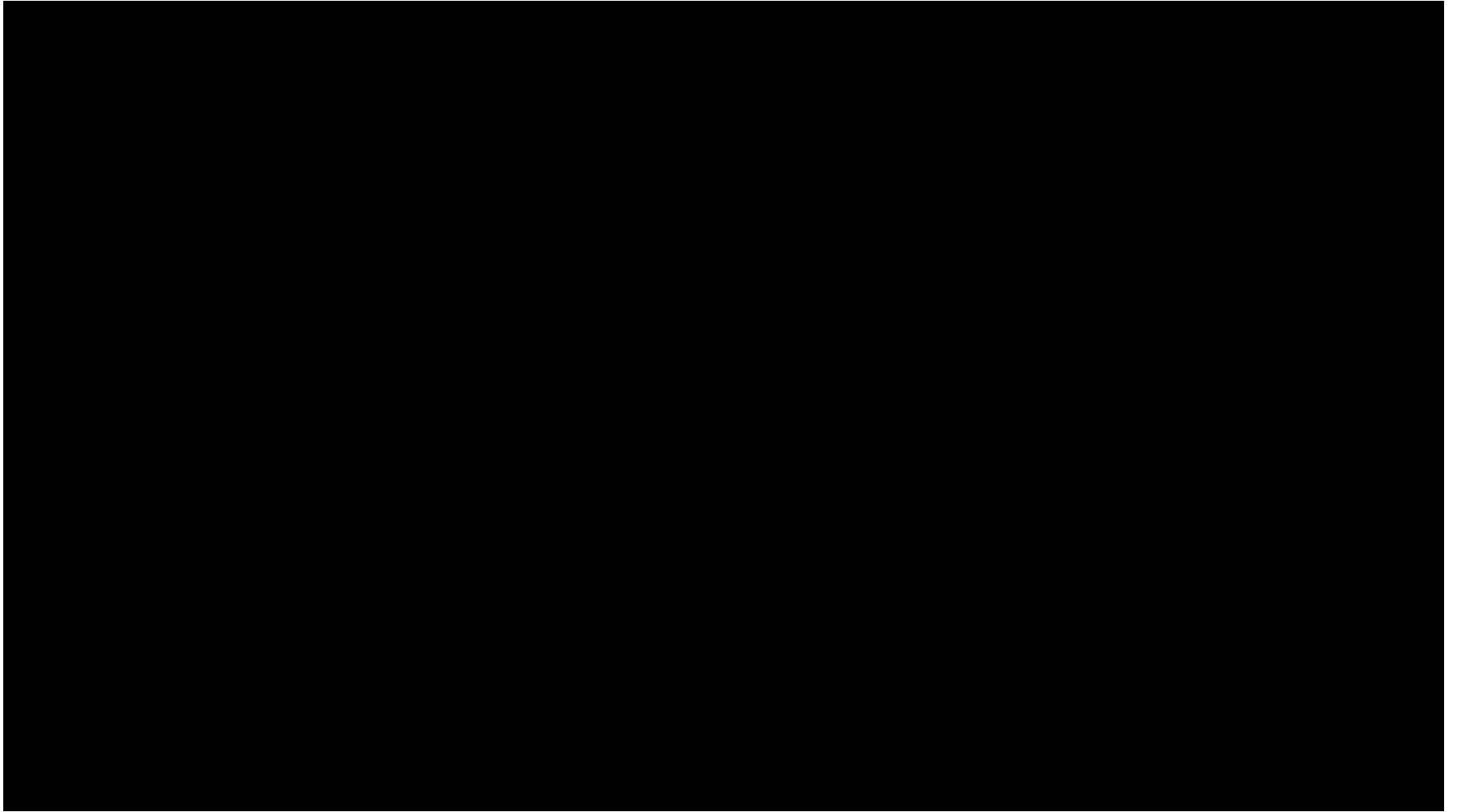
2. Start App



3. Distribute Apples

[https://github.com/apple-o-matic/proto1/blob/master/system\\_engineering/Apple-o-matic\\_Feasibility\\_Evaluation.docx](https://github.com/apple-o-matic/proto1/blob/master/system_engineering/Apple-o-matic_Feasibility_Evaluation.docx)

# Prototype Implementation







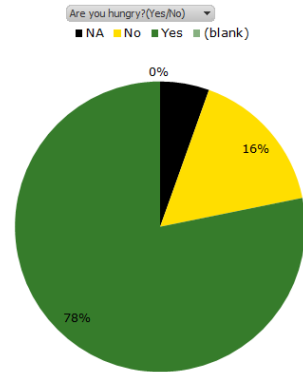
# Project Results of Feasibility Evaluation



Students hungry when provided apples?

Percent Students Hungry

**78% YES**

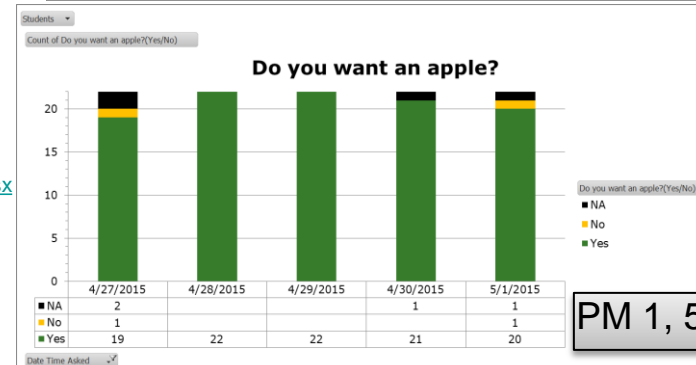
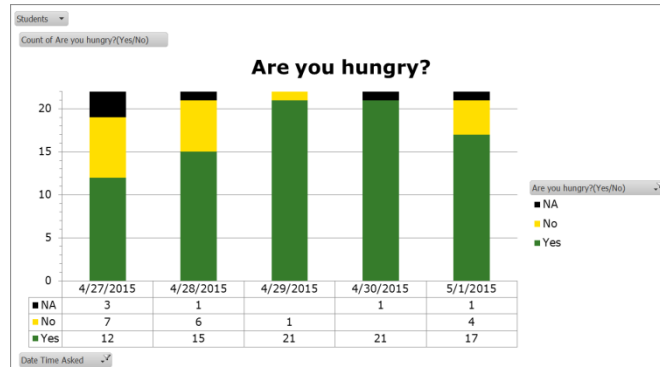
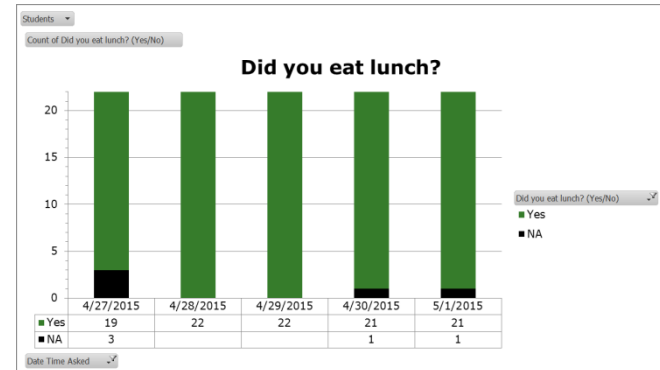
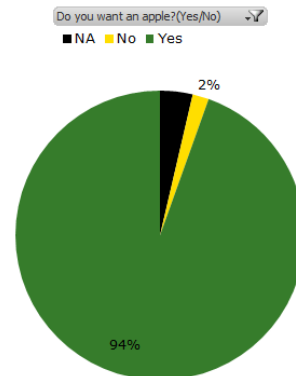


Acceptance of the apples by students?

Percent Apples Taken

**94% YES**

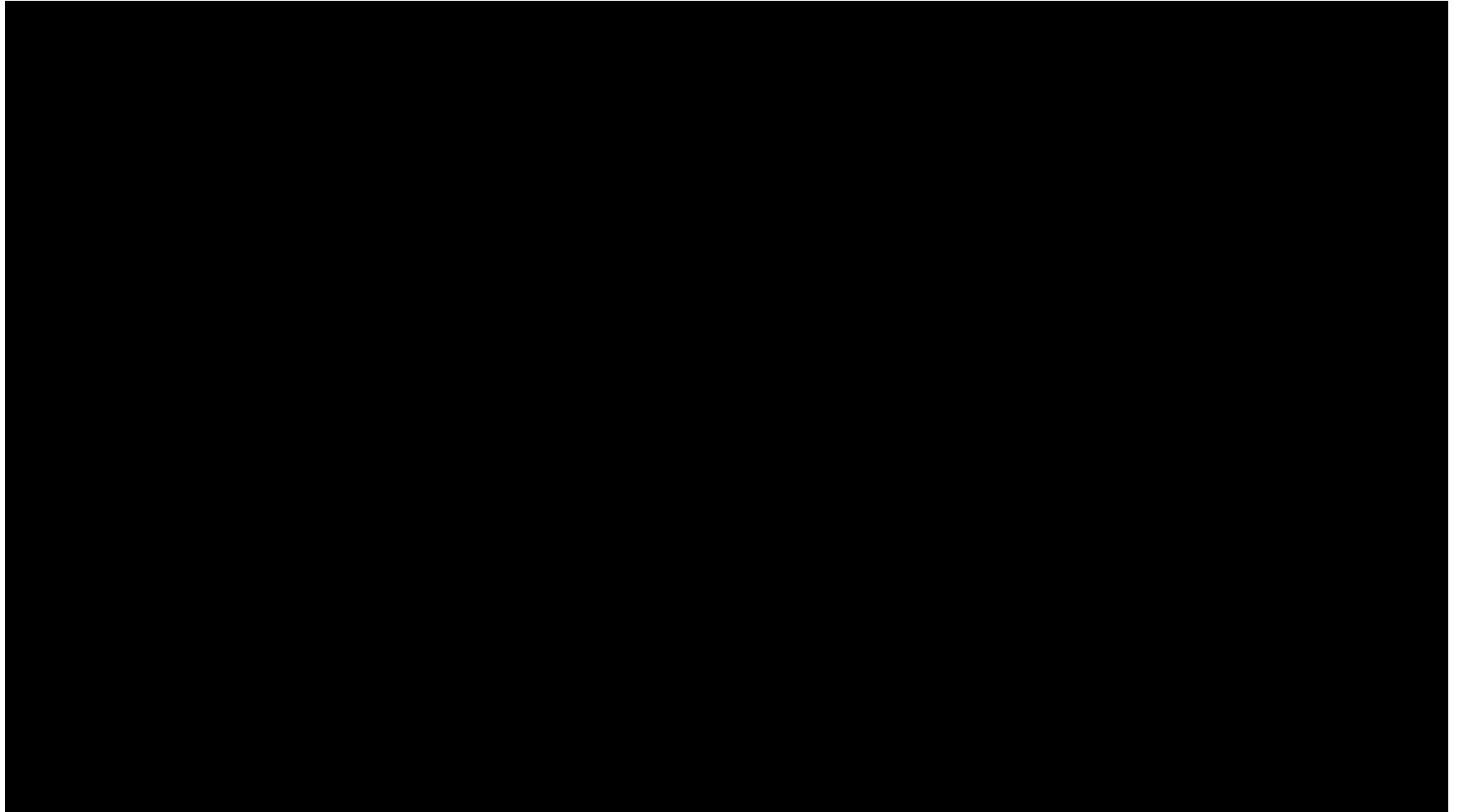
Exceeded goal of 20%



PM 1, 5

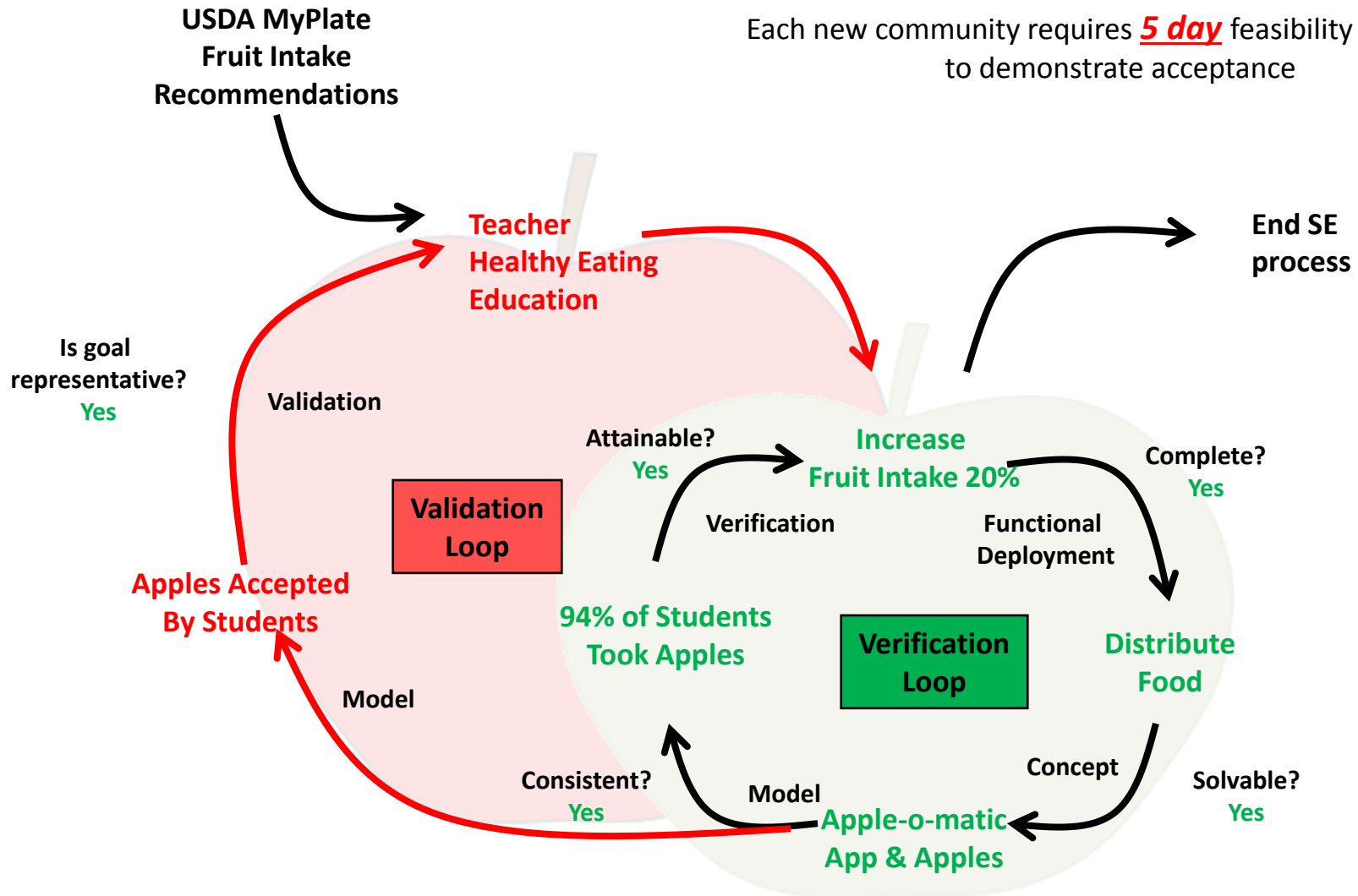
[https://github.com/apple-o-matic/proto1/blob/master/system\\_engineering/Apple-o-matic\\_Evaluation\\_Survey\\_with\\_Results.xlsx](https://github.com/apple-o-matic/proto1/blob/master/system_engineering/Apple-o-matic_Evaluation_Survey_with_Results.xlsx)

# Project Results of Feasibility Evaluation



# Verification and Validation Loops

Each new community requires **5 day** feasibility evaluation to demonstrate acceptance



# Cash Flow Information

- Estimate relative operating cost between different system options (“recipes”)
- Assist Sponsor in estimating specific implementation costs and income needs

INPUTS		
Apple Purchase		
Number of students per class (avg)	20	students
Number of classes per school	10	classes
Number of Schools	1	schools
Frequency apples are served	5	days per week
Apple Consumption Rate	50%	% of students consuming
Apple price (see chart on this page)	0	\$/lb
Apples per pound (avg)	3	apples/lb.

Marketing / Communication		
Campaign costs (printing, postage, etc.)	196	\$/year
Delivery of tax deductible info	13.6	\$/year

Labor Salary/Wages		
Operation Director	0	\$/year
Food Preparation, Delivery & Dist. Rate	15	\$/hr
Time to Prepare food	1	hr/100 apples
Number of apple drop-off sites	10	#

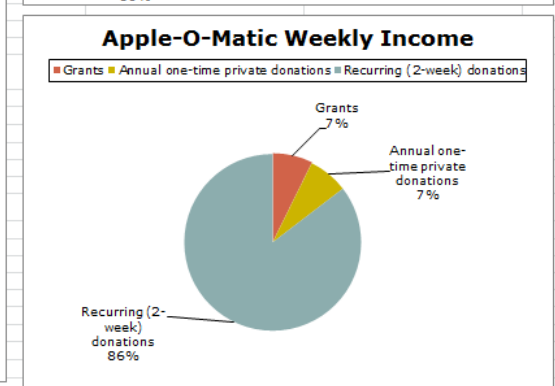
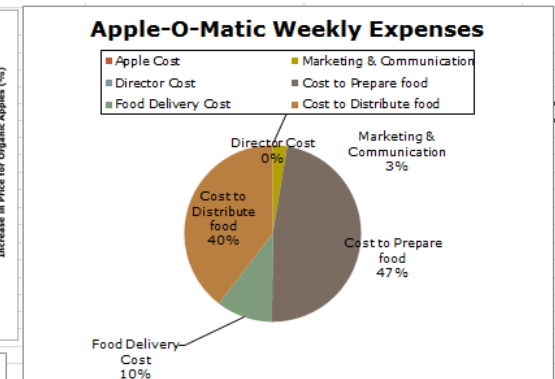
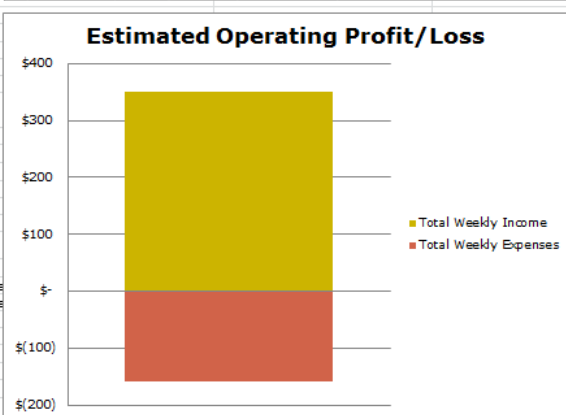
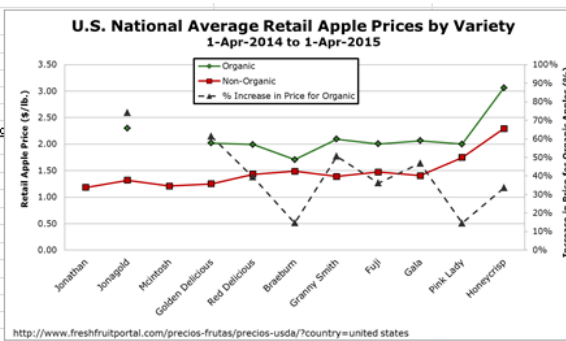
Donations		
Grants	1000	\$/year
Annual one-time private donations	1000	\$/year
# recurring donors	30	#
recurring donors contribution amts (assumed every 2 weeks)	20	\$/2wks

Other		
# of school weeks per year	39	weeks/year

## CALCULATIONS

Apple Purchase		
Total Apples Consumed	100	apples consumed per day
	500	apples consumed per week
Price per apple	0	\$/apple
Apple cost	0	\$/day
	0	\$/week

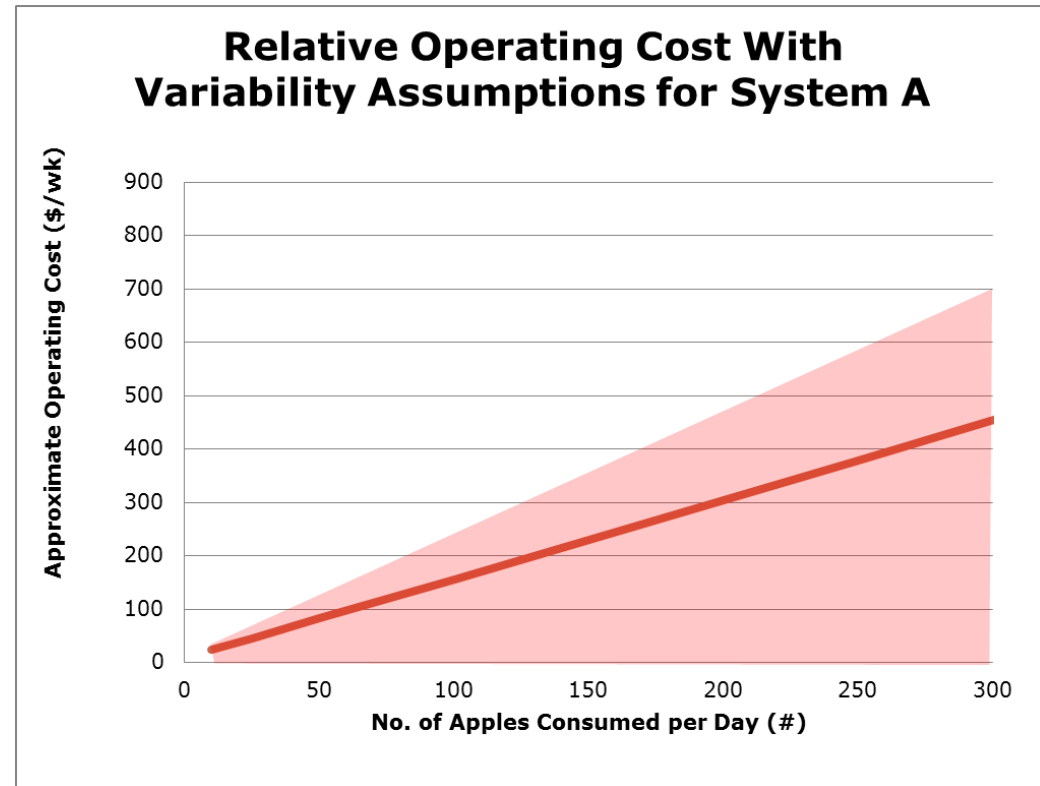
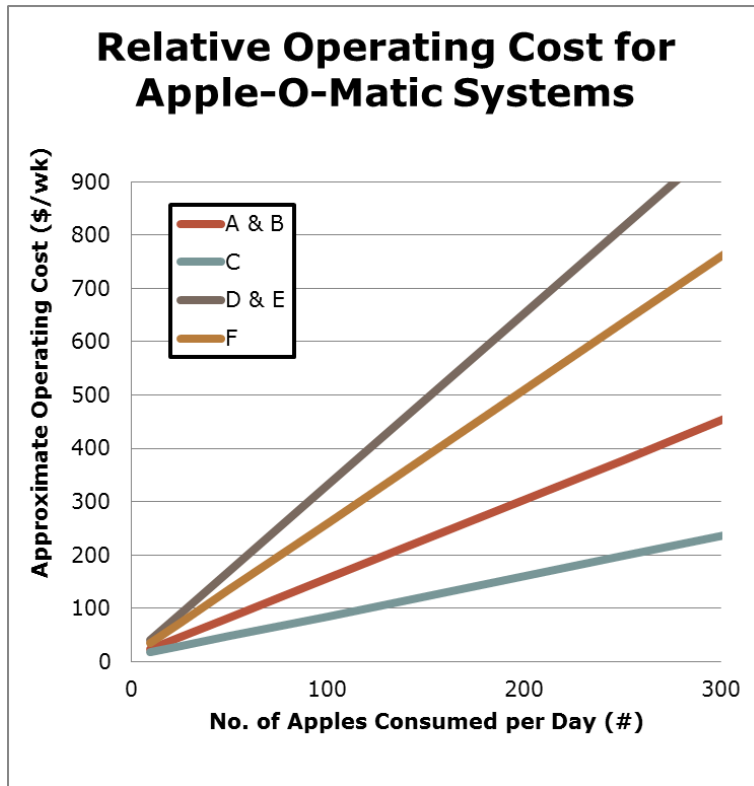
Marketing / Communication		
Total Marketing/Comm. Cost	4.15	\$/wk



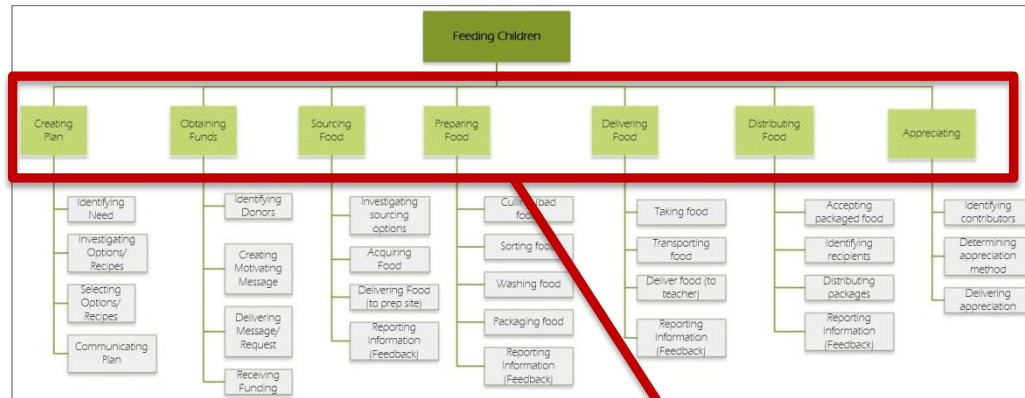
[https://github.com/apple-o-matic/proto1/blob/master/project\\_management/CashFlowSheet.xlsx](https://github.com/apple-o-matic/proto1/blob/master/project_management/CashFlowSheet.xlsx)

# Cash Flow Information

- Assist Sponsor in estimating specific implementation costs and income needs
- Also estimate relative operating cost between different system options (“recipes”)



# Architectural Decisions



- The differences in architectural solutions are a set of implementation variations (or “recipes”) that are available to the project sponsor.

- Architectural impacts first identified by investigating system functional decomposition
- These impacts were then related to two architectural questions.

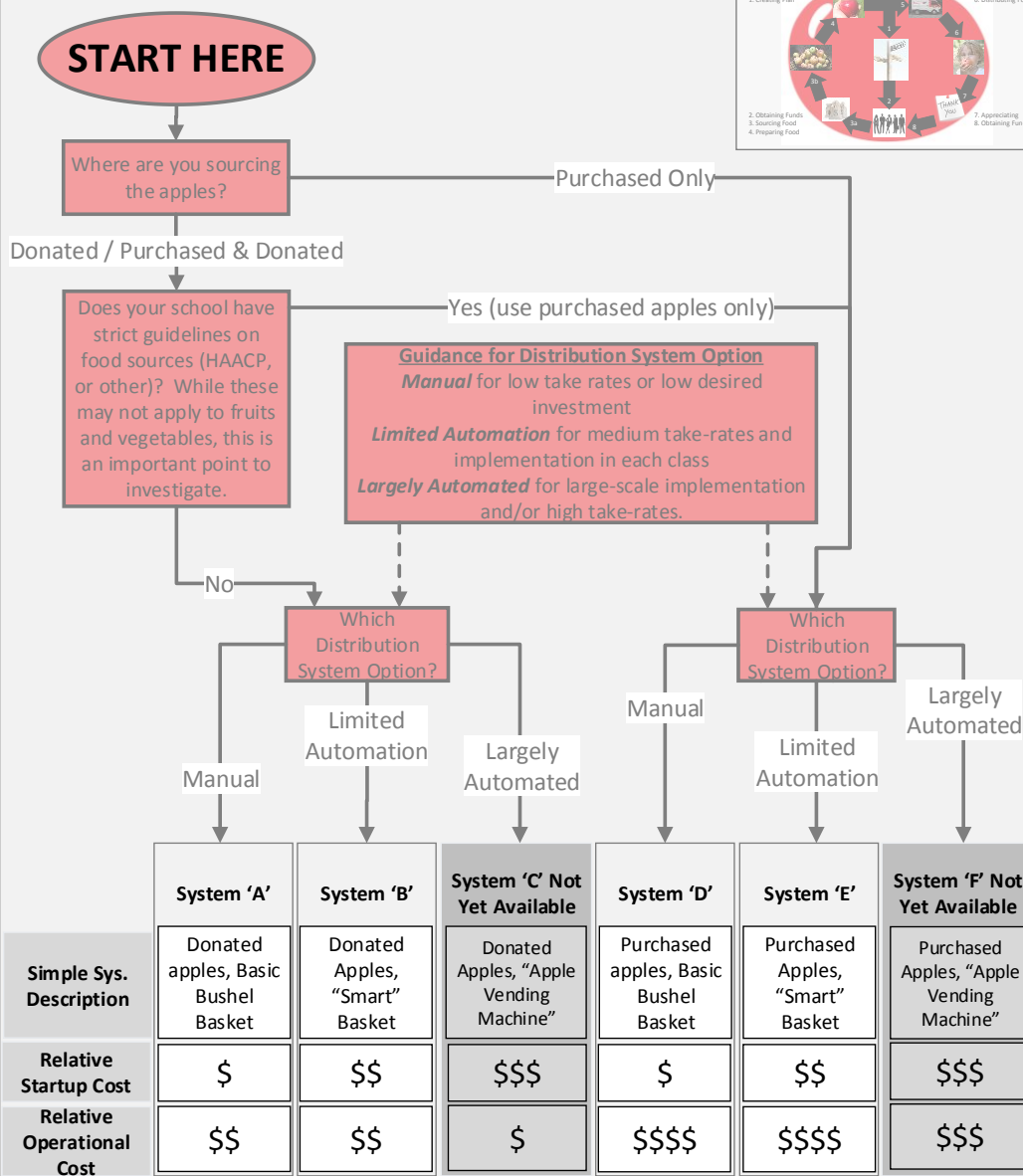
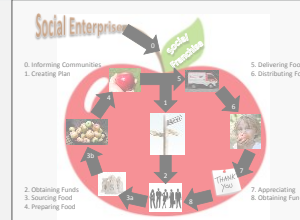
Impacted Area of Operations (Level 1 Decomposition)	Architectural Impact	Question	
		Source of apples (donated or purchased)?	Which Distribution System Option (Simple, Complex, Manual, Automatic)
Creating Plan	None		
Obtaining Funds	Identifying Donors & Delivering Message is a function of how much money is needed (function of what kind of system is selected).	X	X
Sourcing Food	Acquiring Food, Delivering Food, Reporting Information	X	
Preparing Food	Culling, Sorting, Washing, Packaging, Reporting	X	
Delivering Food	Who delivers food? To whom (multiple teachers, central food distribution, etc.)		X
Distributing Food	Identifying recipients, distributing packages, reporting information (Feedback)		X
Appreciating	Identifying Contributors (people deserving feedback depends on apple donations, monetary donations, both, etc.)	X	X

# Recipe Selection Guide

## HOW SHOULD I SET UP THE APPLE-O-MATIC SYSTEM?

### A HANDY FLOWCHART TO HELP YOU DECIDE

INSTRUCTIONS: Follow the flowchart to a potential solution at the bottom of the page. Find the reference material for that solution in the system manual.



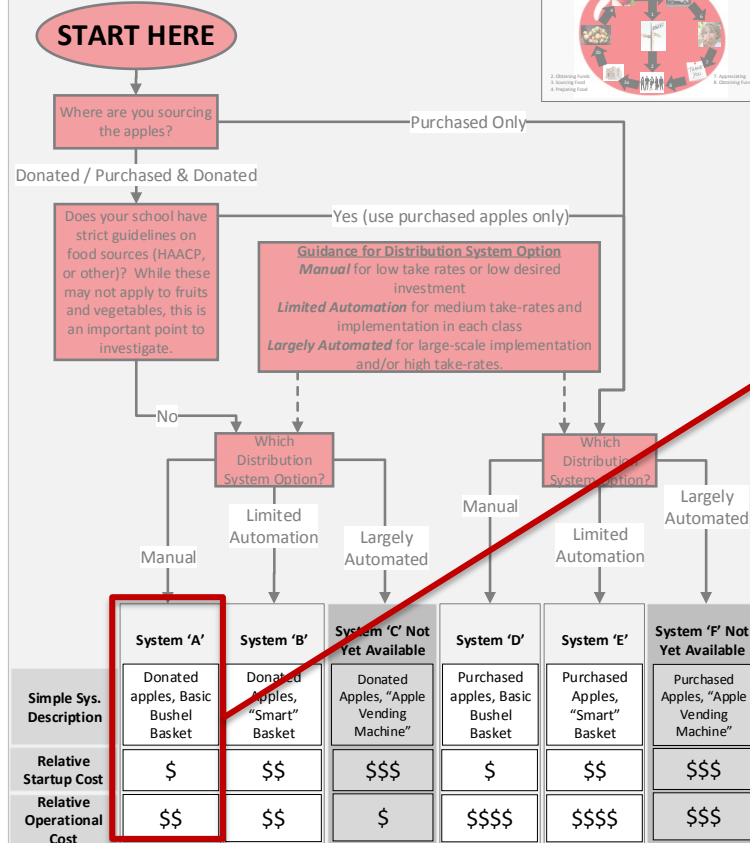


# Recipe Sheet

## HOW SHOULD I SET UP THE APPLE-O-MATIC SYSTEM?

### A HANDY FLOWCHART TO HELP YOU DECIDE

INSTRUCTIONS: Follow the flowchart to a potential solution at the bottom of the page. Find the reference material for that solution in the system manual.



## Recipe\_A Operational Plan: Donated apples, Basic Bushel Basket

### Step 1: Creating a Plan

- Project sponsor is to identify and define the need. If you've come this far, you have likely already identified the need (specific school, district, grade, etc.).
- Once you have this identified, visit our "Apple-O-Matic" flowchart to choose review the recipe options, and pick one that most suits your needs (the "recipe" you're reading now is one of those options). Also, use the Cash Flow Sheet (provided) to make estimates for needed startup and ongoing funds required. Make sure that your funding sources can continue to provide funding at the needed levels (and use this to set the scope of your donor network).
- Communicate the plan to your high-level stakeholders (school administration, teachers, etc.).

### Step 2: Obtaining Funds

- Identify your donors. Understand their needs; what motivates them? How do they like to donate?
- Write a motivating message that explains the end goals of the project (feeding apples to children), explains the mechanism (the Apple-O-Matic service), and explains what you need from them (how much, how often; financial, labor, apples, etc.). Be specific in your needs (e.g., we need xx people to deliver yy dollars on a weekly ongoing basis). Make sure that the expectations are known. In this particular solution, we'll be asking the donors to also help donate apples (can be from their backyard, the grocery store, etc.). Set expectations for quality/cleanliness of apples (as this affects workload and expense when the apples are brought into the system).
- Deliver the message. Use a medium that makes the most sense for your donors (P.T.A. meetings, email, twitter, snail mail, etc.); this should be part of what you discovered in part 'A'.
- Receive funding. Set up a bank account to deposit the funds. If you're interested in crowdsourcing the donations, investigate "TinBox" as a resource to support this. Additionally, investigate grants (public and private) to support ongoing funding, as well as initial startup money. Use the cash-flow sheet (from Step 1) to guide this effort.

### Step 3: Sourcing Food

- Recipes A & B call involve some level of apple donations from your donor network. This is a great hands-on opportunity for your donors, and really reduces operating cost (apples are over 50% of the operating cost of the system), but can also add some additional complications and questions. You will likely need to obtain apples from other sources in the off-season, and the delivery of the donated apples is likely to be irregular (requiring trips to the grocery store to make up the difference on short notice). Make sure you consider this in your implementation. Also be sure that you follow school and governmental regulations regarding bringing food into the school (cleanliness, safety, allergies, etc.). Reference HACCP regulations.
- What are your sourcing options? Donors can provide apples from their backyards, or pick up an extra bag of apples when at the grocery store. Maybe their neighbors have too many trees, and they would be willing to donate that extra? Make sure your requests are known to your donor network (Step 2 above). Will you operate the service in the off-season? If so, where will you get the apples? Continued donations, or from the school cafeteria supplier?
  - How will you receive the food? Where will the donations be brought in and recorded? When and where? How often? Where will you store them? These questions need to be considered for donated and purchased apples.
  - How will you deliver them to the preparation site? Who is responsible for this? How are they compensated?
  - Be sure that the people involved in this step understand their roles and responsibilities, and give feedback to you on quantity of food brought in, quality issues, process issues, and any other system operation issues identified. Feedback is important.

### Step 4: Preparing Food

- This step is very important, especially for your donated food. Apples sourced from traditional stores and school cafeteria supply network are likely already cleaned and sorted (but verify). The benefit of low cost food (donated apples) is partially offset by needing to spend more effort on this step. Consider engaging students in this step to understand the farm-to-school (or farm-to-table) process, and use this as an educational opportunity. You will likely also need other help to do this; this could be hired staff (which will affect your cash-flow) or volunteers.
- Cull out the bad apples. Have an "apple purge" at regular intervals (don't keep any apple longer than xx weeks). Look for worm damage, spoilage, etc.
  - Sort the food; if you're receiving donations, you're going to get various varieties of apples, so give each class a good mix. Larger-sized apples can be sorted to older classes.
  - Wash the food. You have no idea where these apples have been and which chemicals they have been exposed to (another good opportunity to set expectations with your donor network), so be sure to wash them. Don't trust your donors to do this step for you outside of your control; YOU are responsible for this.
  - Package the food according to how it is distributed (large central stevens, class-by-class).
  - Again, feedback to the system administrator is important.

### Step 5: Delivering Food

- Transport the food to the distribution site(s). If there are large quantities of apples being delivered, make sure that the appropriate carts are being used (could be handling several hundred pounds of apples per day, depending on the size of the school, and frequency of distribution).
- Clean the distribution system (purge old apples, wipe down the distribution basket/machine). This is an important step in cleanliness. Inspect the distribution system for problems and report back.
- Load the system (basket, machine, etc.) with new apples.
- Feedback.

### Step 6: Distributing Food

- In this simple system, it is likely that the teacher will be responsible for distribution. They are the best ones to identify the appropriate time to distribute the apples, however research indicates that mid-afternoon (2pm?) is a good time for a healthy snack.
- Identify the recipients. Is there a target audience? If not, general distribution is recommended (and easier to support).
  - Distribute the apples; this could be connected to educational information as well.
  - Consumption could be restricted until a different time, however there is less opportunity for damage to fruit and creating messes if the food is consumed immediately.
  - Feedback, Feedback, Feedback.

### Step 7: Appreciating

- One of the critical items in this system is the donors; this does not work without your donors (apples and/or monetary). Make sure you appreciate them appropriately.
- Keep good records to understand who has donated into the system, and how much. Monetary donations are tax-deductible, and donors WILL EXPECT that you give them a tax receipt to deduct from their taxes. Donations of fruit may be tax deductible, but we recommend that the donor speaks with their tax advisor about how to handle this.
  - Determine how to appreciate them. A variety of methods works well at different times throughout the year (Twitter, email, handwritten letter, phone call, recognition from school administration & P.T.A. school newsletter). The important part is to make it personal... if it's a canned message, they don't "appreciate" it as much.
  - Deliver the appreciation.

### Step 8: Obtaining Funds

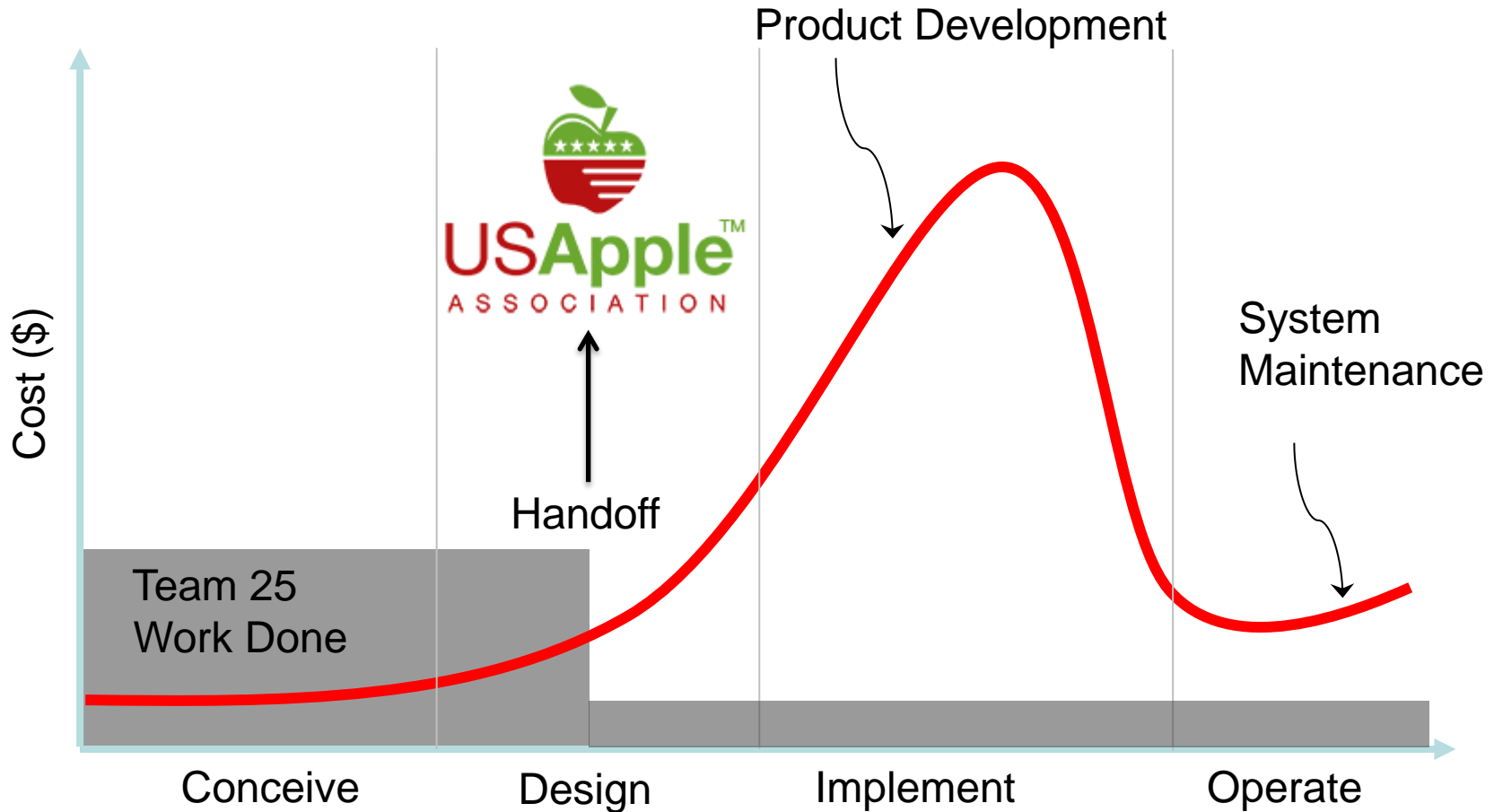
See information in Step 2

[https://github.com/apple-o-matic/proto1/blob/master/project\\_management/Recipe%20Flowchart.pdf](https://github.com/apple-o-matic/proto1/blob/master/project_management/Recipe%20Flowchart.pdf)

# Product Development Effort

<b>Make your own Apps</b>					
<b>Software Development</b>			<b>Sub-Totals</b>	<b>Duration (weeks)</b>	<b>Comments</b>
Number of Software Engineers	2	engineers			1 Android OS developer/ 1 iOS developer
Number of System Engineers	1	engineer			5 years Requirements and Testing Experience
Hourly Rate	\$50	\$/hour			
Requirements Documentation using Agile	40	hours	\$2,000	1	Define User Stories and Acceptance Criteria
Software Design	40	hours	\$4,000	1	Software Engineers document screen mockups with flow
Software Coding	240	hours	\$24,000	6	Software Engineers create code for smartphone and tablets
Software Automated Testing	160	hours	\$16,000	4	Software Engineers create automated test for demos
Software Reviews/Demos	20	hours	\$1,000	4	System Engineers Accept Completed User Stories
Development Environment	\$5,000	\$/engineer	\$5,000		Mac/PC/Server/Software
<b>System Testing</b>					
Beta Release Field Testing	80	hours	\$12,000	2	
Go to Production Field Testing	80	hours	\$12,000	2	
<b>Total Development Costs</b>			\$76,000	USD	5 months

# Project Lifecycle



# Reflections on Systems Thinking

- Socio-technical Service vs Product
- Swirling / zig-zagging / Recursion
- System of systems

# Acknowledgments

- John Helferich – Mentor
- Wendy Brannen – US Apple
- Juliana Cohen – Harvard Dept. of Nutrition
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- Eric Toot – Johnston, IA Principal